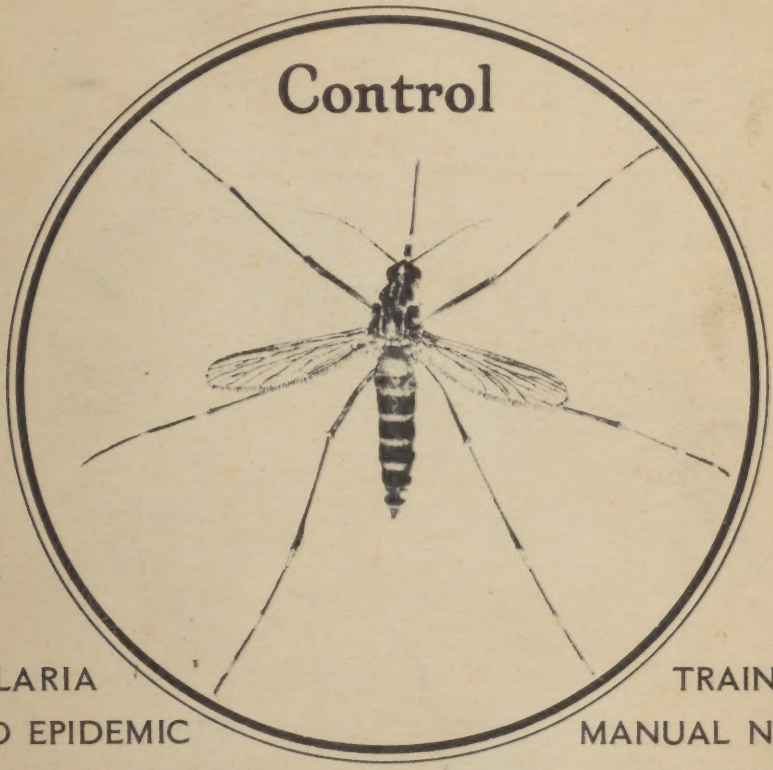
Dengue Fever and Mosquito Control



MALARIA AND EPIDEMIC DISEASE CONTROL

TRAINING MANUAL NO. 4 FOR ALL PERSONNEL

SOUTH PACIFIC AREA

From: The Commander South Pacific.
To : South Pacific Force and South Pacific Area.

Subject: Dengue in the South Pacific Area.

Enclosure: (A) Training Manual Number Four.

1. The accompanying Manual on Dengue Fever and and Mosquito Control in Military and Naval forces in the South Pacific is published for the information of all forces operating under the South Pacific Command.

2. The information contained therein will be widely published and used as a guide in the control of Dengue Fever in our forces.

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Deputy Commander,
South Pacific Force.

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DENGUE FEVER AND MOSQUITO CONTROL

1. Nature of the Disease.

Dengue or "breakbone fever" is an acute, non-fatal disease, caused by a filterable virus and is common in many parts of the world. It is found in temperate climates, but is of particular importance in tropical and subtropical regions.

This disease is characterized by its sudden onset. Other symptoms are: severe rheumatic pains in the joints and limbs, headache, and high fever. A "saddle-back" type of fever is frequently noted. An initial fever of three or four days is followed by a short remission, and then a second attack of one to two days duration. The second attack is often accompanied by a rapidly spreading rash. An attack of the disease renders one immune for at least six to twelve months, possibly longer.

The necessity of routine thick film diagnosis of all suspected cases of malaria is brought out by the fact that malaria and dengue often are very similar. *Table I is a tabulation of the most common symptoms of one hundred (100) cases of malaria and one hundred (100) cases of dengue occuring in the South Pacific.

TABLE I

Symptoms or Signs	Dengue (100 Cases)	Malaria (100 Cases)
Frontal headaches	88%	96%
Chilly sensations	55%	22%
True chill	10%	56%
Pain in eyes	78%	59%
Red conjunctivae	97%	not noted
Low backache	74%	79%
Pain on eye movement	25%	common
Abdominal symptoms	17%	47%
Toxic rash	35%	none
Temperature 103° F. or over	55%	68%
Saddle-back temperature	25%	none
"Dengue" rash	18%	none
Joint aches	common	72%

There is no specific treatment for dengue. Treatment is entirely supportive: aspirin or a similar drug is often required to relieve aches and pains.

2. Importance of the Disease.

Dengue is second only to malaria as a tropical disease of military importance in this theater. In 1942 and 1943 serious epidemics occurred among the armed forces on New Caledonia, Espiritu Santo, and Tulagi. The peak of the epidemic on all bases coincided fairly closely with the height of the rainy season.

The importance of dengue has been a problem that unfortunately has been given scant attention due to the overshadowing specter of malaria. However, it has caused serious loss of time in this area and, as our forces advance into other tropical areas the threat of dengue epidemics must not be overlooked.

3. Method of Transmission.

Dengue is a mosquito-borne disease, the principal vector being **Aedes aegypti**, a small black mosquito with conspicuous white banded legs and patches of white scales on the sides of the thorax. This species is found in large numbers over a world-wide distribution. **Aedes albopictus** has also been incriminated in the transmission of the disease. Both species bite freely during the day as well as at night. The mosquito vector must bite an infected person during the first three days of the fever, as this is the only time the virus is present in the blood stream. After a short period of incubation and multiplication within the body of the mosquito, the insect becomes infected and is able to transmit dengue at any time during the rest of its life by biting a susceptible man.

4. Life history of Aedes aegypti.

In addition to mating, at least one blood meal from man or any warm blooded animal is essential for the production of fertile mosquito eggs. The female **Aedes** prefers to deposit her eggs on a moist surface in an artificial container rather than directly onto the water. They are laid singly and may remain in a dry condition for several weeks or months, hatching upon submersion. There is a great variation in the number of eggs per batch, but fifty is not uncommon. The average length of life of an **Aedes aegypti** female is probably not more than six weeks to two months. However, they will remain alive much longer in a warm moist atmosphere when they are well provided with food.

The **Aedes** wigglers or larvae develop rapidly in warm climates such as the Pacific Islands and become adult mosquitoes in seven to nine days. They seem to thrive in an artificial container of fairly clear rain water which is rich in decaying vegetable matter. They are seldom if ever found in sewage polluted water. The pupal or tumbler stage is passed in twelve to thirty-six hours and the adult mosquitoes emerge. The cycle from egg to adult is readily passed in seven days in the tropics.

5. Control of Aedes aegypti.

This mosquito shows a definite preference for breeding in artificial containers in a domestic environment. Some of the principal breeding places are rain barrels, tubs, tanks, cisterns, cans of all sizes, bottles, eaves, pots, discarded pails, jars, discarded tires, watering troughs, dishes of water, vases, tops of oil drums sitting upright, old shoes, holes in trees, canvas tarpaulins holding water left by rain; anything that will hold water for ten days should be looked upon with suspicion.

The purpose of the following section is to show a portion of the problems encountered during an **Aedes aegypti** control program in Noumea, New Caledonia. Military forces, wherever dengue is endemic, will be faced with many of these same problems. No other mosquito can be so readily controlled by the individual soldier, sailor, or marine. It is a simple matter to empty a barrel or a tin can.

Figure 1 — Javanese Village

Some evidence of the mosquito breeding hazards afforded by the Javanese and Tonkinese settlements can be obtained from this photograph. All water is hauled from a single source and kept around the cooking quarters in a wide variety of pans, five gallon cans and fifty-five gallon barrels. Too much for immediate use is kept on hand, and consequently considerable breeding of mosquitoes is allowed. The natives have no ideas on improving this situation. The only definite control is to watch them dump every container once weekly.

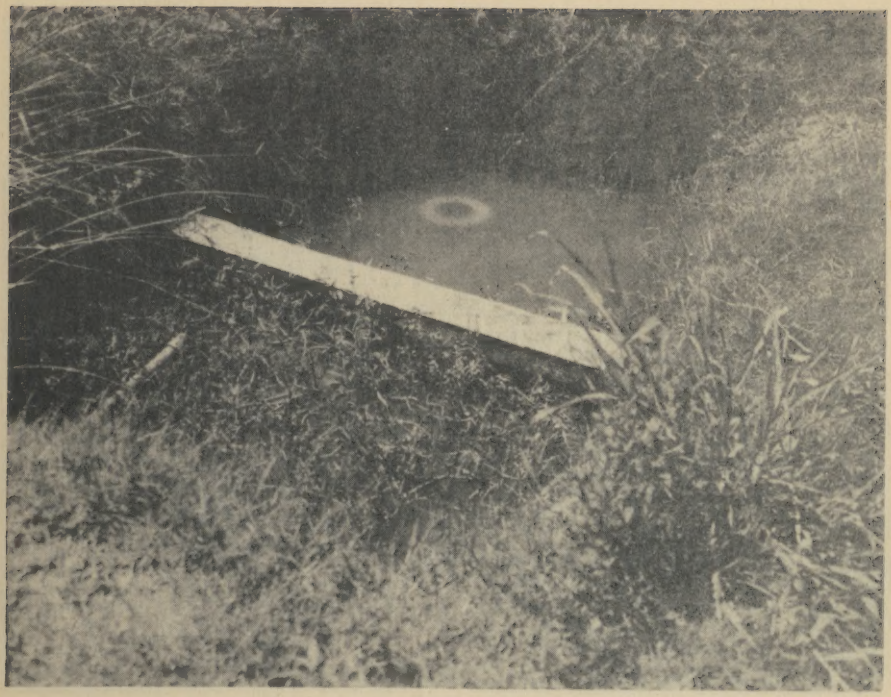

Figure 2 — Semi-permanent Rain Pool

This pool of water in the back yard of a French home is semi-permanent, and a small number of **Aedes aegypti** were collected from it, together with a large number of pest mosquitoes. This is not a characteristic breeding spot, but the presence of **A. aegypti** in it indicates that any type of water that is allowed to stand for a week or more in a domestic environment should be under suspicion.

Figure 3 — Irrigation System

This view of a Javanese truck garden irrigation system shows the origin of a great many of the mosquito problems faced by our military organization. Only a few of these barrels sunk in the ground are being utilized to provide irrigation water. The others have several inches of water in them and unless oiled will breed countless hordes of mosquitoes which upon hatching will descend upon the barracks in the background. The barrels used for irrigation are sprayed with a pyrethrum larvicide which will not harm plants. Deisel oil or kerosene can be used if necessary.

Figure 4 — Bottles and Barrels in Back Yard

This is an example of many of the backyards encountered in doing dengue mosquito control. Bottles are scattered about, and some of them hold water and mosquito wigglers. Numerous barrel halves and tin cans can also be noted. These must be emptied once each week as the natives can seldom be taught mosquito control.

Figure 5 —Mosquito Breeding in Automobile Tires

These two tires are a small part of many tons found in a military supply dump. They were stacked uncovered in a low area which was covered by a foot of water in a heavy rain. All of the lower layers of tires were filled with this water, and many of the upper ones by the rain. Some of the larger tires held several gallons of water. Multiply this amount by the tremendous number of tires present in such dumps, and some idea of the total breeding problem will be obtained. A crew of fifty men worked three days shifting the tires, emptying as much water as possible out of each tire, and pouring a cup of oil into each tire.

Figure 6 — Tin Can Dump

This tin can dump near the kitchen of a military organization gives an excellent picture of improper disposal of tin cans. These cans hold enough rain water to breed immense numbers of mosquitoes. This is one of the favorite breeding places of **Aedes aegypti.** The cans should always be flattened and buried. If handled in this manner they never present a mosquito problem.

Figure 7 — Flooded Basement

Many of the basements in the Noumea area were found to contain several inches of water due to leaky waterpipes and running faucets. Water also seeps in through cellar walls in several instances due to the very low elevation. One of these situations can develop enough mosquitoes to infest several square blocks, as they swarm out of the water in unbelievably large numbers. When the water can not be drained, the surface is covered with a non-inflammable pyrethrum larvicide which kills the wigglers.

Figure 8 — French Cemetery

The custom of placing vessels of various sizes on the graves for holding flowers creates a serious **Aedes aegypti** problem. An attendant keeps these vessels filled with water in anticipation of the grave lot owners' desire to place flowers in them. Rain water also helps to keep them filled. All of the vases should be removed from the cemetery entirely to obtain complete control. They should at least be emptied once weekly.

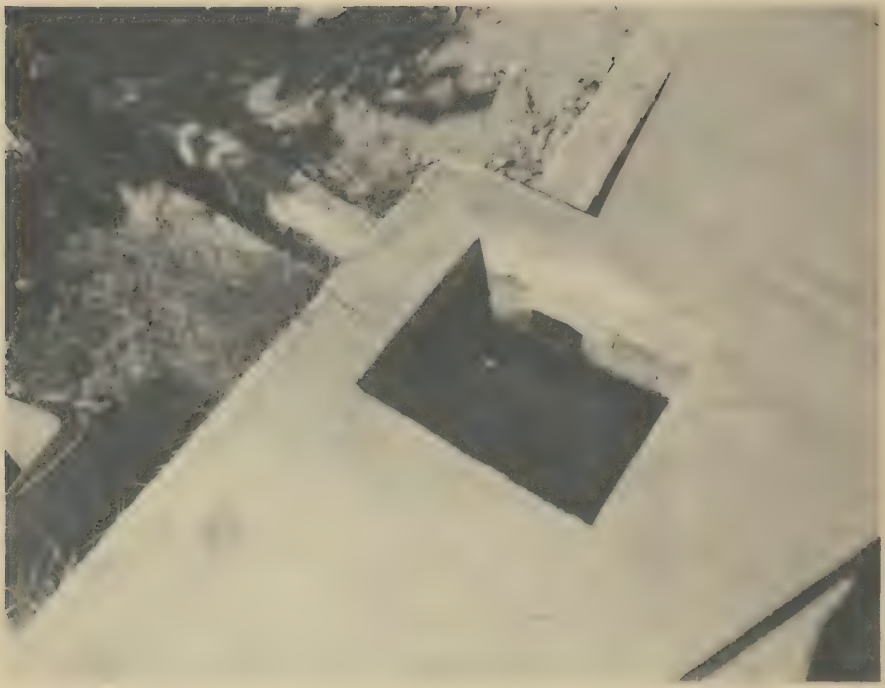

Figure 9 — Uncovered Cisterns

A considerable amount of rain water is collected in cisterns, water tanks, and rain barrels on the Pacific islands for drinking or cooking purposes. These cisterns and other containers are seldom found to be completely covered. The clear rain water is taken full advantage of by the **Aedes aegypti.** These situations were impossible to oil, so the residents concerned had to be prevailed upon to build wooden covers for them. Screening of tanks and cisterns is as effective.

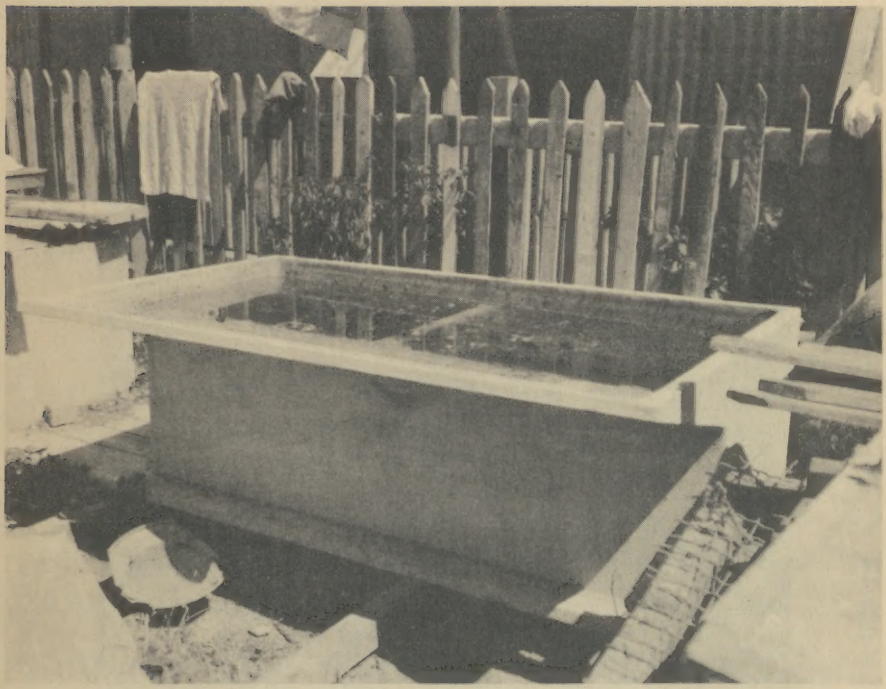

Figure 10— Unused Washtub

This concrete washtub when discovered had been abandoned by its owner and was full of foul water which contained immense numbers of mosquito larvae, including **Aedes aegypti. A. aegypti** apparently prefers clean water, but occasionally they will be found breeding prolifically in foul water. They seem to prefer water polluted by decaying vegetable matter, and to avoid sewage polluted streams. This problem was easily taken care of by turning the tub upside down.

Figure 11— Slit-trench

This trench was dug as a protection against air raids and holds over a foot of rain water. It was teeming with larvae before it was oiled. This is an excellent example of the maintenance necessary around all military establishments to prevent the breeding of disease transmitting mosquitoes. If the trench were in use it should be pumped or bailed out frequently since there is no way to drain it. However, since this trench is not in use it can be oiled regularly or eliminated completely by filling in with earth.

6. Dengue Discipline.

By far the best method of controlling dengue is the elimination of **Aedes aegypti** mosquitoes by killing their wigglers. However, when it is not possible to eradicate all **Aedes aegypti** in a city, village, or other area where troops are quartered, and dengue is or has been present, every effort should be made to prevent **Aedes agypti** from biting troops.

Where **Aedes aegypti** and dengue are a threat, the following precautions should be observed:

a. Working and sleeping quarters should be screened when possible. Particular efforts should be made to at least screen bathing and latrine facilities.
b. Unless sleeping in properly screened quarters all personnel should sleep under bed nets.
c. Dress of the day should be long trousers, shoes, and full sleeve shirts which are buttoned and tucked in trousers. The custom of wearing shorts and going without shirts during working hours should be strictly forbidden due to the daytime biting habits of **Aedes aegypti**; all undue exposure of large areas of the body should be discouraged.
d. Swimming parties should be forbidden if mosquito bites are common.
e. Sleeping and working quarters should be sprayed out several times daily with insecticide sprays. Use of insect repellents, while not as efficient as against malaria mosquitoes, should be encouraged, and application several times daily will diminish mosquito bites.

7. Organization for Dengue Control.

The Malaria and Epidemic Control organization has in effect a dengue control program on all bases where dengue or **Aedes aegypti** is present. On malarious bases this program is run in conjunction with the malaria control program, and while supervised by trained malaria and epidemic control personnel **is a responsibility of all units** (ComSoPac Serial 01619). On all bases where **Aedes aegypti** is present it is the duty of the mosquito control squad of each unit to carefully police their assigned area and regularly remove, empty, overturn, or oil all artificial containers capable of breeding **Aedes.**

Insecticides, repellents, and other dengue control supplies will be drawn by unit supply officers from base quartermaster or Navy Supply facilities under regular pest control allowances.

It must be stressed that the control of dengue is a command responsbility for each base and each unit within a base. Failure to carry out the simple and effective measures necessary for controlling **Aedes aegypti** mosquitoes may and frequently will result in costly dengue epidemics.